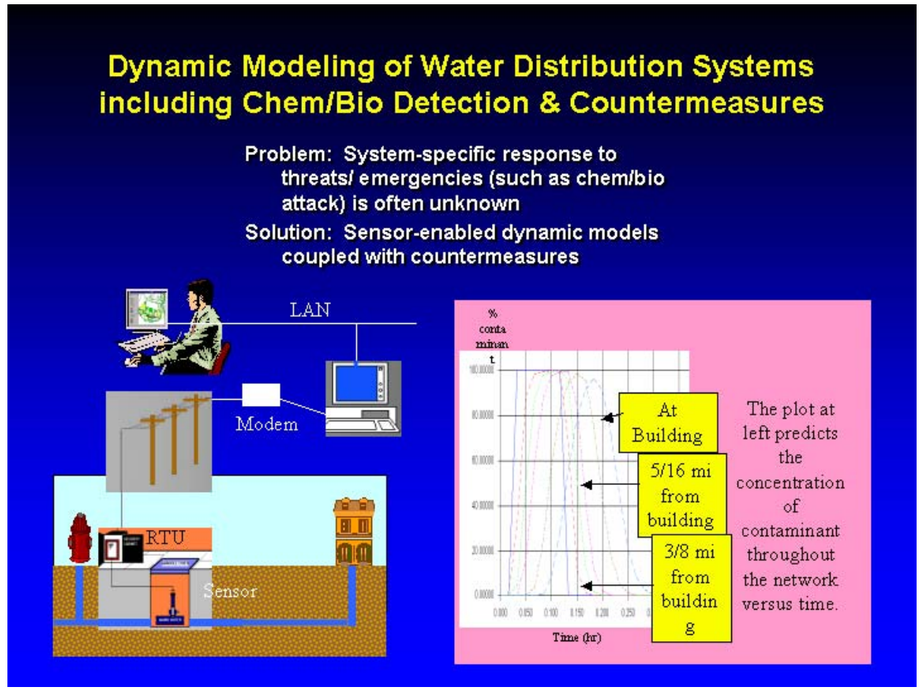
FORT FUTURE
Force Projection



Sensor-enabled dynamic models will help detect chem/bio contamination and plan protective responses.

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Force Projection

by Vincent Hock, Vicki VanBlaricum, and William Taylor ERDC/CERL TN-02-3 October 2002

Dynamic Modeling and Simulation Tools for Utility Systems

Background

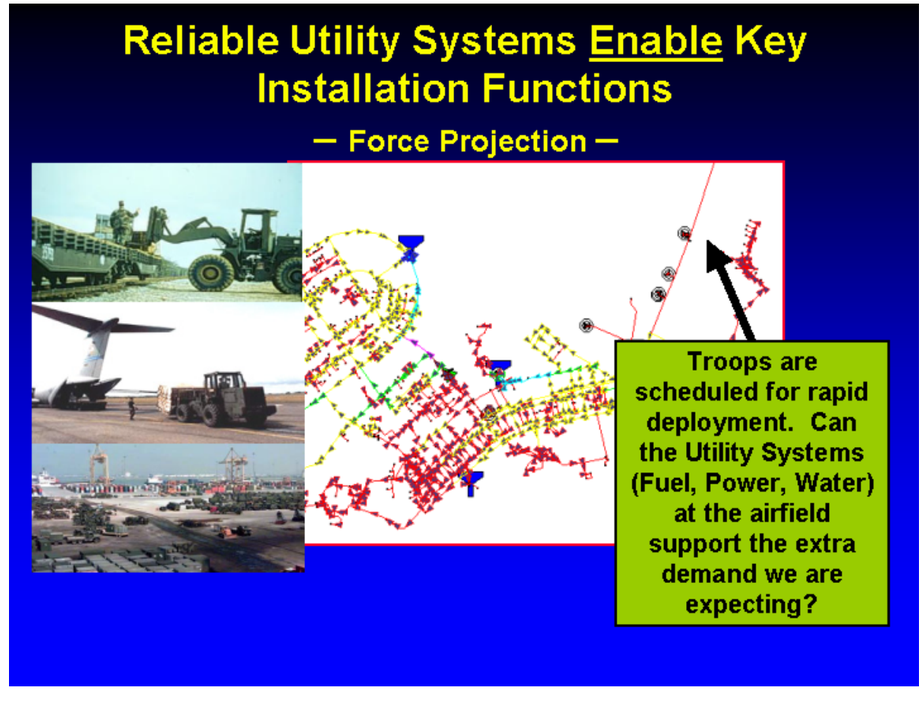
The Fort Future force projection module is being developed to optimize, through simulation, the process of preparing and deploying equipment and personnel. Using a graphical user interface (GUI), the module will integrate data input through operational history, strategic planning, and hypothetical tactical scenarios to evaluate existing force projection capabilities and plan future upgrades to meet Objective Force requirements.

Problem

Utility systems are "enablers" for the force projection process. They provide the electricity, water, transportation fuel, heating, cooling, compressed air, and communications required for the various steps of force projection. To sustain a successful campaign, deployed soldiers must arrive "combat-ready" with all necessary supplies, power, water, and fuel. Attack or sabotage can potentially delay time-critical missions and pose threat to health and life. Manpower and budget reductions have adversely impacted the ability to address threat issues. The appropriate response to emergencies/threats is often a "best guess."

In addition, the existing utility infrastructure may not be adequate to mobilize and deploy future AC and RC. Each installation is unique in terms of physical location, characteristics, condition of facilities, and mission. All of these factors impact the capability of a utility network to support force projection.

Unfortunately, due to the nature of utility systems, no "one-size-fits-all" solution exists. Thus, a dynamic modeling and assessment tool is necessary.



Modeling and simulation tools can aid in utility contaminant prevention, detection, and mitigation.

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14. ABSTRACT
Utility systems are ?enablers? for the force projection process. They provide the electricity, water, transportation fuel, heating, cooling, compressed air, and communications required for the various steps of force projection. To sustain a successful campaign, deployed soldiers must arrive ?combat-ready? with all necessary supplies, power, water, and fuel. The existing utility infrastructure may not be adequate to mobilize and deploy future AC and RC. This work will develop methods, simulation tools, and models to enable installation and military planners to plan, assess, optimize, and monitor the ability of utility systems to support Army force projection. Users will be able to conduct utility system simulations using real-time data, as well as historical, generic, or hypothetical scenarios. The utility module will interface as a component of the large-scale Fort Future Force Projection package.

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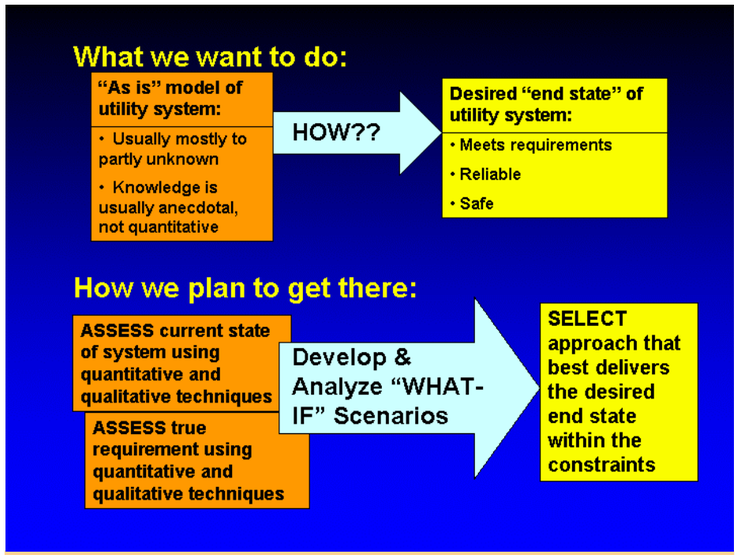

Reliable utility systems are key to Force Projection and Protection. This figure illustrates the utility system modeling course of action.

Approach

This work will develop methods, simulation tools, and models to enable installation and military planners to plan, assess, optimize, and monitor the ability of utility systems to support Army force projection. The user will be able to conduct utility system simulations using real-time data, as well as historical, generic, or hypothetical scenarios. The utility module will interface as a component of the large-scale Fort Future Force Projection package. For water utilities, the approach includes:

- Pilot testing water dynamic system models for normal operations
- Developing methods to assess system vulnerability
- Identifying requirements for CBR contaminant scenarios, through sensor enabled dynamic modeling of changing water chemistry
- Analyzing potential system operation modify-cations, prevention measures, and mitigation techniques based on real-time modeling data
- Predicting the water system's response to different contaminant scenarios.
- Modify software to incorporate the above.

For fuel systems, the approach includes:

- Adapting a water system model to represent the hydraulic differences of fuels (viscosity, specific gravity, additional equipment etc.)
- Customizing a modeling tool to analyze military-specific scenarios (conventional operation, mobilization, contamination, blast/fire)
- Predicting future conditions, including effects on capacity and risk of failure
- Incorporating real-time sensing and control.

For electrical systems, the approach includes:

- Reviewing commercial off-the-shelf software
- Develop requirements including: power flow assessment, cost analysis, reliability assessment, service restoration analysis, and Distributed Generation (DG) management.
- Develop "what if" scenarios such as: failure of specific equipment or part of the system, adding/modifying a facility, destructive event, and changing facility activity/load level
- Develop/modify software to incorporate the above.

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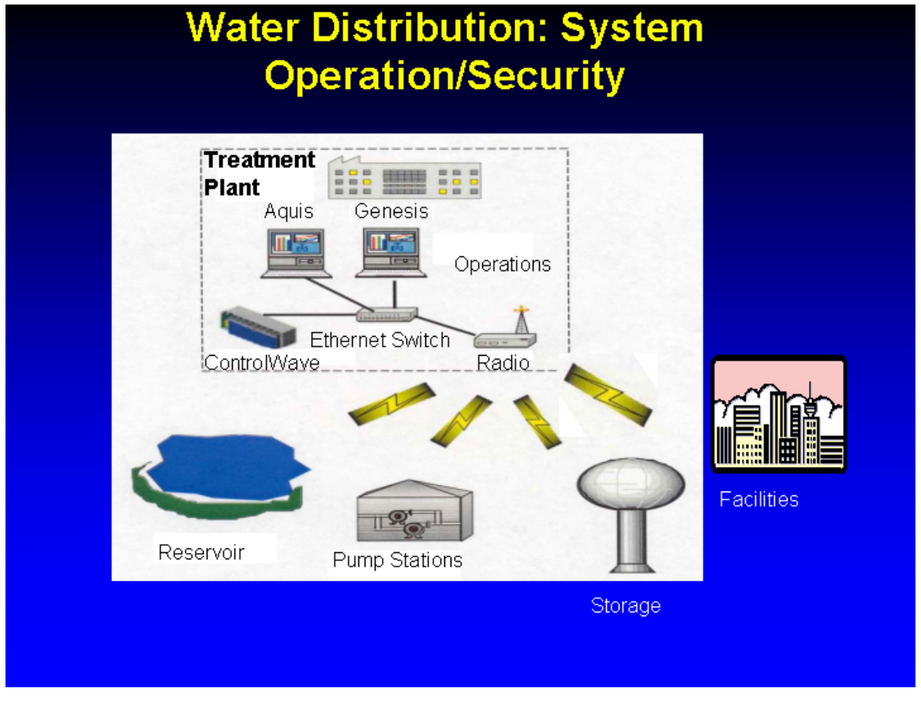
Tools

System control and data analysis tools are needed in operations and management for process monitoring and automation. A communication network within a water distribution system would consist of workstations located in a control room, which would allow users to view the entire process and perform control actions. Within a facility, process controllers supervise unit processes, such as treatment and filter operation. A local area network (LAN), such as Ethernet, links controllers to the workstations. Remote terminal units (RTU) are used in remote sites, such as reservoirs, pump stations, storage tanks, and facilities (shown below). Modeling and simulation tools can be useful in a distribution system as a whole to ensure system threat prevention, detection, and elimination.

Benefits

Dynamic modeling and simulation tools will enable users to:

- Dynamically model complex/changing utility system processes
- Make decisions based on real time data
- Access powerful analytical and graphical tools to readily convey information and results
- Design effective emergency response plans
- Update design criteria to support force projection
- Determine chemical/biological detection and countermeasures
- Improve normal operation efficiency.



Modeling and simulation tools can help prevent, detect, and eliminate system threats.